Bioavailability of Lead and Arsenic in Soil

One of the major considerations in the development of a soil cleanup level is the bioavailability of the lead or arsenic in the soil. This is the amount of lead or arsenic that is absorbed from the stomach into the bloodstream when children or adults inadvertently ingest soil. The US Environmental Protection Agency (USEPA) has developed and conducted studies in juvenile swine to assess the bioavailability of lead and arsenic contaminated soils for over 20 years now. The results of the bioavailability studies have been used at numerous Superfund Sites to more accurately estimate exposure and develop remediation levels.

The bioavailability study design and protocols were developed by a team of interdisciplinary scientists which included veterinarians, pharmacologists, toxicologists, chemists, quality assurance specialists, geologists and statisticians from the USEPA, University of Missouri College of Veterinary Medicine, Michigan State University Department of Pharmacology and Toxicology, Michigan State University Department of Large Animal Clinical Sciences, the Centers for Disease Control and Prevention, and the University of Colorado at Boulder. Nineteen different test soils were evaluated for lead bioavailability in the juvenile swine model and 26 different test soils were evaluated for arsenic bioavailability. These test materials came from mining and smelting sites, woodtreating sites, lead-based paint and pesticide application sites. The study design and specific results have been published in a number of peer-reviewed journal articles and books. More importantly the juvenile swine animal model, study design and protocols have been accepted nationally by the USEPA to estimate the bioavailability of lead and arsenic from contaminated soil at hazardous waste sites. The USEPA considers the juvenile swine bioavailability work to be the gold standard against which alternate animal models, such as the mouse model, or *in vitro* (bench top) bioaccessibility assays are compared and validated to gain scientific credibility and national acceptance.

At the Butte Priority Soils Operable Unit site a number of animal bioavailability studies were conducted on soils from residential yards and source areas. It was found that only a very small amount (approx 10%) of the lead in soil is actually absorbed. This site-specific estimate of bioavailability was used to more accurately estimate risk and develop soil cleanup levels for Butte.

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